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RETROGRADE,CHARNOCKITE- GNEISS RELATIONS IN SOUTHERN INDIA; C.Srikantappa, K.G.Ashamanjari, K.N.Prakash Narasimha, Department of Geology, University of Mysore, Manasagangotri, Mysore 570 006, India; and M.Raith, Mineralogisch-Petrologishes Institut, Universitat Bonn, Poppelsdorfer Schloss, 5300 Bonn, West Germany.

The Nilgiri charnockite massif (Δ 2694 m above MSL) in southern India is bordered by two major shear belts viz. Moyar and Bhavani, formed probably during late Proterozoic times. The Moyar shear belt separates the predominantly amphibolite facies gneissic terrane (Dharwar Craton, 3.4 b.y. old,[1]) in the south. This shear belt is upto 20 km. wide and 200 km. in length. LANDSAT imagery studies coupled with field observations indicate the development of a major N 30°W trending lineament cutting the earlier N 70-80°E to E-W trending shear fabric. The structures within the Bhavani shear belt which forms the southern boundary of the Nilgiri charnockite massif is N 60-70°E trending, essentially parallel to the structures of the Nilgiris. These shears are cut by late N-S to N20°W shear planes. Southern boundary of the Bhavani shear belt joins with the wide plains of Noyal-Cauvery shear belt.

The high-pressure charnockites (P = 8-9 Kb., T = 700-800°C CO_2-rich fluid regime) of the Nilgiri hills show evidence of retrogression related to shear deformation within the Moyar and Bhavani shear belts. Two types of retrogression have been noticed. (1) Retrogression along shear planes, and (2) Retrogression along pegmatitic veins.

Initial stages of retrogression results in the formation of irregular, 2-3 cm to one meter wide bleached zones with the removal of greasy grey colour of charnockites. Minor structures which were earlier obscured in charnockites are clearly seen in bleached areas. In intensely shear areas, formation of highly fissile grey gneiss results often with the development of flaser and mylonitic structures.

Occurrence of pseudotachylites confined to areas adjacent to the Nilgiri granulite terrane and the shear belts suggest to their formation related to the upliftment of Nilgiris. Pseudotachylites show fine grained texture with feldspar+ quartz+biotite. Presence of a melt phase is noticed. It is not clear whether these pseudotachylites represent product of cataclasis or frictional fusion[2].

Petrographic observation of gneisses within the shear zone show breakdown of granulite facies mineral assemblage. Garnet exhibit cataclastic texture, traversed by veins of chlorite, and biotite. They exhibit symplectitic intergrowth with plagioclase and quartz. Both ortho and clinopyroxenes show alteration to greenish blue hornblende, actinolite,

cummingtonite/grunerite, and biotite. Plagioclase show alteration to epidote and talc. Relict granulitic texture is noticed in some thin sections studied despite intense retrogression. As a result of pronounced deformation and shearing, quartz grains are flattened, and occur as ribbon like bands when compared to polygonal texture of quartz noticed in Nilgiri charnockites.

Fluid inclusion studies and geochemical investigations carried out for serial samples collected from charnockite to gneiss indicate following features: (1) There is a gradual decrease in density of CO_2-rich fluids from 1.073 to 0.821 g/cm^3(Fig.1). (2) Interestingly, in many sections of the gneisses studied, there is almost complete absence of fluid inclusions suggesting that they would have decrepitated. This may be due to large pressure difference (2-3 Kb.) created between the interior and exterior of the fluid inclusions[3], (3) Presence of mixed CO_2-H_2O inclusions were noticed. (4) Presence of low salinity (2-14 wt.% NaCl equivalent) bi-phase H_2O-rich inclusions (0.925-0.725 g/cm^3) suggest re-hydration during retrogression. (5) Fluid inclusion studies in quartz pegmatites indicate presence of low density CO_2-rich inclusions (0.840-0.659 g/cm^3) as well as H_2O-rich inclusions (0.900-0.525 g/cm^3).

Geochemical studies suggest depletion of Al_2O_3, FeO, MgO and CaO, and enrichment of SiO_2, Na_2O, K_2O, Rb and Sr. REE patterns studied for one pair of charnockite and gneiss show enrichment of LREE and strong depletion of HREE in the gneiss. However, in some of the samples studied, metasomatism appear to be insignificant during retrogression of charnockites.

References:

[1] Buhl, D. (1987) unpublished Ph.D thesis, University of Munster.
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[3] Hollister, L.S., Burrus, R.C., Henry, D.L. and Hendel,E.M. (1979) Bull. Mineral, 102, p.555.561.

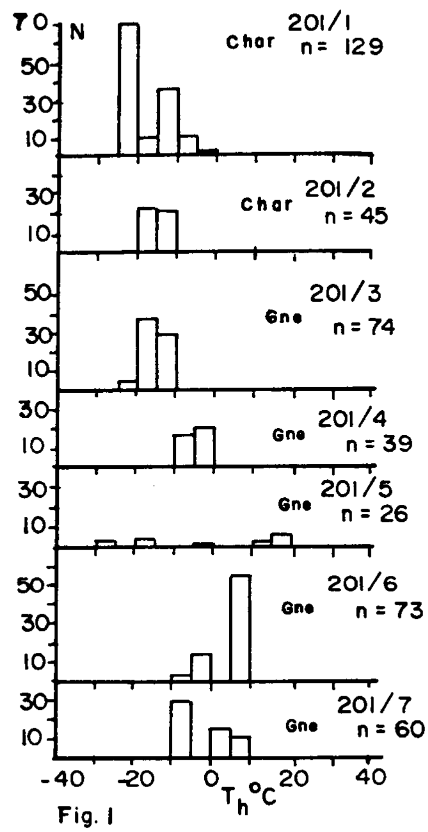

Fig.1 Temperature of homogenisation (T_h) of CO_2-rich inclusions for serial samples from charnockite to gneiss, Moyar shear belt. Char. = charnockite, gne. = gneiss.